

Maximum Ratings / Höchstzulässige Werte

Parameter	Condition	Symbol	Datasheet values	Unit
			max.	

Transistor Inverter
Transistor Wechselrichter

Collector-emitter break down voltage Kollektor-Emitter-Sperrspannung		V_{CE}	1200	V
DC collector current Kollektor-Dauergleichstrom	$T_j=150^{\circ}\text{C}$ $T_h=80^{\circ}\text{C}$, $T_c=80^{\circ}\text{C}$	I_C	38 50 limited by bond	A
Repetitive peak collector current Periodischer Kollektorspitzenstrom	$t_p=1\text{ms}$ $T_h=80^{\circ}\text{C}$	I_{cpuls}	76	A
Power dissipation per IGBT Verlustleistung pro IGBT	$T_j=150^{\circ}\text{C}$ $T_h=80^{\circ}\text{C}$, $T_c=80^{\circ}\text{C}$	P_{tot}	68 102	W
Gate-emitter peak voltage Gate-Emitter-Spitzenspannung		V_{GE}	± 20	V
SC withstand time Kurzschlußverhalten	$T_j \leq 125^{\circ}\text{C}$ $V_{GE}=15\text{V}$	t_{SC} V_{CC}	10 900	us V

Diode Inverter
Diode Wechselrichter

DC forward current Dauergleichstrom	$T_j=150^{\circ}\text{C}$ $T_h=80^{\circ}\text{C}$, $T_c=80^{\circ}\text{C}$	I_F	26 35,5	A
Repetitive peak forward current Periodischer Spitzenstrom	$t_p=1\text{ms}$ $T_h=80^{\circ}\text{C}$	I_{FRM}	52	A
Power dissipation per Diode Verlustleistung pro Diode	$T_j=150^{\circ}\text{C}$ $T_h=80^{\circ}\text{C}$, $T_c=80^{\circ}\text{C}$	P_{tot}	41 62	W

Thermal properties
Thermische Eigenschaften

max. Chip temperature max. Chiptemperatur		T_{jmax}	150	$^{\circ}\text{C}$
Storage temperature Lagertemperatur		T_{stg}	$-40 \dots +125$	$^{\circ}\text{C}$
Operation temperature Betriebstemperatur		T_{op}	$-40 \dots +125$	$^{\circ}\text{C}$

Insulation properties
Modulisolation

Insulation voltage Isolationsspannung	$t=1\text{min}$	V_{is}	4000	Vdc
Creepage distance Kriechstrecke			min 12,7	mm
Clearance Luftstrecke			min 12,7	mm

Characteristic values

Description	Symbol	Conditions					Datasheet values			Unit
		T(C°)	Other conditions (Rgon-Rgoff)	VGE(V) VGS(V)	VCE(V) VDS(V)	IC(A) IF(A) Id(A)	Min	Typ	Max	

Transistor Inverter, inductive load
Transistor Wechselrichter

Gate emitter threshold voltage Gate-Schwellenspannung	$V_{GE(th)}$	Tj=25°C Tj=125°C	VCE=VGE			0,002	5	5,8	6,5	V
Collector-emitter saturation voltage Kollektor-Emitter Sättigungsspannung	$V_{CE(sat)}$	Tj=25°C Tj=125°C		15		50	1,71	1,95	2,3	V
Collector-emitter cut-off Kollektor-Emitter Reststrom	I_{CES}	Tj=25°C Tj=125°C		0	1200				0,4 6	mA
Gate-emitter leakage current Gate-Emitter Reststrom	I_{GES}	Tj=25°C Tj=125°C		30	0				650	nA
Integrated Gate resistor Integrierter Gate Widerstand	R_{gint}							4		Ohm
Turn-on delay time Einschaltverzögerungszeit	$t_{d(on)}$	Tj=25°C Tj=125°C	Rgon=18 Ohm Rgoff=18 Ohm	±15	600	50		72		ns
Rise time Anstiegszeit	t_r	Tj=25°C Tj=125°C	Rgon=18 Ohm Rgoff=18 Ohm	±15	600	50		22		ns
Turn-off delay time Abschaltverzögerungszeit	$t_{d(off)}$	Tj=25°C Tj=125°C	Rgon=18 Ohm Rgoff=18 Ohm	±15	600	50		462		ns
Fall time Fallzeit	t_f	Tj=25°C Tj=125°C	Rgon=18 Ohm Rgoff=18 Ohm	±15	600	50		182		ns
Turn-on energy loss per pulse Einschaltverlustenergie pro Puls	E_{on}	Tj=25°C Tj=125°C	Rgon=18 Ohm Rgoff=18 Ohm	±15	600	50		4,87		mWs
Turn-off energy loss per pulse Abschaltverlustenergie pro Puls	E_{off}	Tj=25°C Tj=125°C	Rgon=18 Ohm Rgoff=18 Ohm	±15	600	50		5,12		mWs
Input capacitance Eingangskapazität	C_{ies}	Tj=25°C Tj=125°C	f=1MHz					3,6		nF
Output capacitance Ausgangskapazität	C_{oss}	Tj=25°C Tj=125°C	f=1MHz					0,18		nF
Reverse transfer capacitance Rückwirkungskapazität	C_{rss}	Tj=25°C Tj=125°C	f=1MHz					0,16		nF
Gate charge Gate Ladung	Q_{Gate}	Tj=25°C Tj=125°C						280		nC
Thermal resistance chip to heatsink per chip Wärmewiderstand Chip-Kühlkörper pro Chip	R_{thJH}	Thermal grease thickness≤50um Wärmeleitpaste Dicke≤50um, λ = 0,61 W/mK						1,04 0,6864		K/W
Coupled thermal resistance inverter diode-transistor Gekoppelte Wärmewiderstand Wechselrichter Diode-Transistor	R_{thJH}	Thermal grease thickness≤50um Wärmeleitpaste Dicke≤50um, λ = 0,61 W/mK						0,55		K/W

Diode Inverter
Diode Wechselrichter

Diode forward voltage Durchlaßspannung	V_F	Tj=25°C Tj=125°C				50		2,35 2,04	3,35	V
Peak reverse recovery current Rückstromspitze	I_{RM}	Tj=25°C Tj=125°C	Rgon=18 Ohm	±15	600	50		109		A
Reverse recovery time Sperrverzögerungszeit	t_{rr}	Tj=25°C Tj=125°C	Rgon=18 Ohm	±15	600	50		60		ns
Reverse recovered charge Sperrverzögerungsladung	Q_{rr}	Tj=25°C Tj=125°C	Rgon=18 Ohm	±15	600	50		8,4		uC
Reverse recovered energy Sperrverzögerungsenergie	E_{rec}	Tj=25°C Tj=125°C	Rgon=18 Ohm	±15	600	50		2,97		mWs
Thermal resistance chip to heatsink per chip Wärmewiderstand Chip-Kühlkörper pro Chip	R_{thJH}	Thermal grease thickness≤50um Wärmeleitpaste						1,72 1,1352		K/W
Coupled thermal resistance inverter transistor-diode Gekoppelte Wärmewiderstand Wechselrichter Transistor-Diode	R_{thJH}	Thermal grease thickness≤50um Wärmeleitpaste Dicke≤50um, λ = 0,61 W/mK						0,53		K/W

NTC-Thermistor
NTC-Widerstand

Rated resistance Nennwiderstand	R_{25}	Tj=25°C	Tol. ±5%				4,46	4,7	4,94	kOhm
Deviation of R100 Abweichung von R100	$D_{R/R}$	Tc=100°C	R100=435Ohm					3		%/K
Power dissipation given Epcos-Typ Verlustleistung Epcos-Typ angeben	P	Tj=25°C						210		mW
B-value B-Wert	$B_{(25/100)}$	Tj=25°C	Tol. ±3%					3530		K

flowPACK 1, 1200V, 50A
Output inverter

Figure 1. Typical output characteristics
Output inverter IGBT
 $I_C = f(V_{CE})$

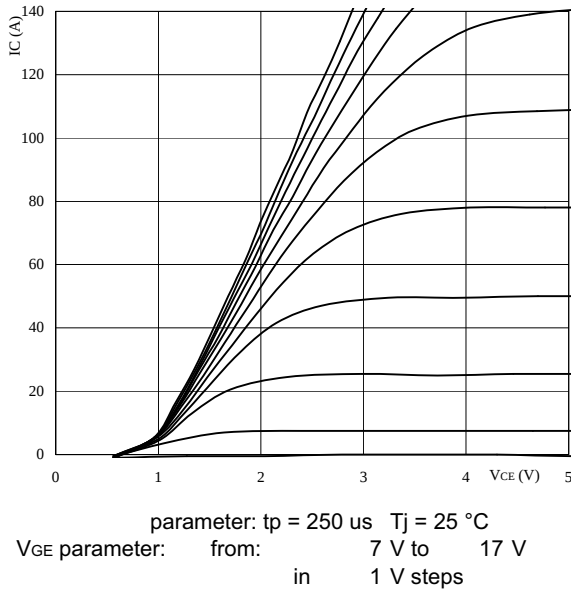


Figure 2. Typical output characteristics
Output inverter IGBT
 $I_C = f(V_{CE})$

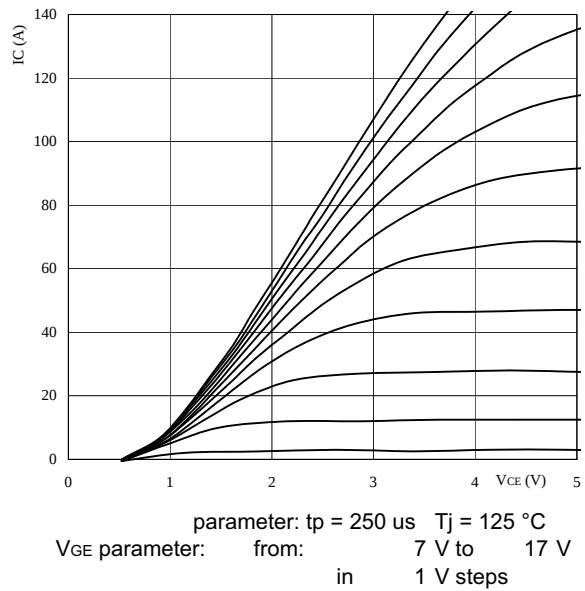


Figure 3. Typical transfer characteristics
Output inverter IGBT
 $I_C = f(V_{GE})$

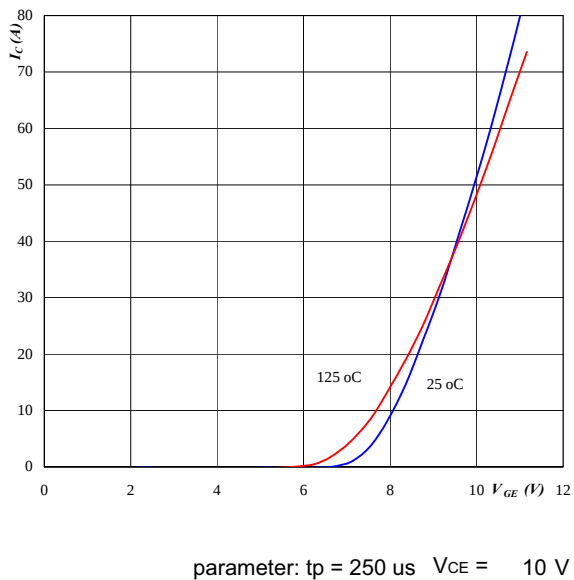
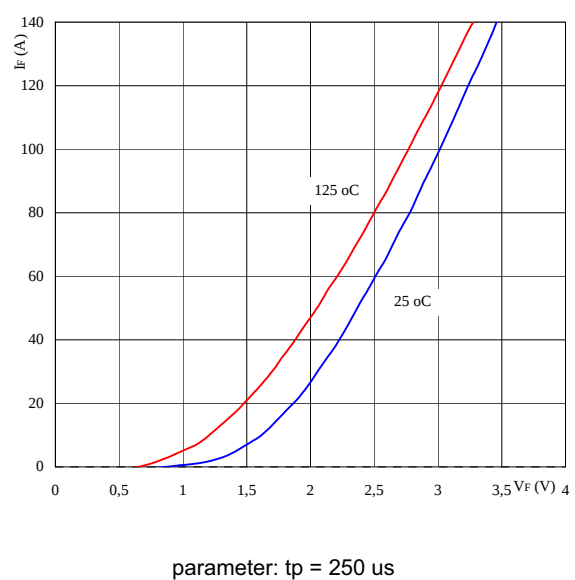
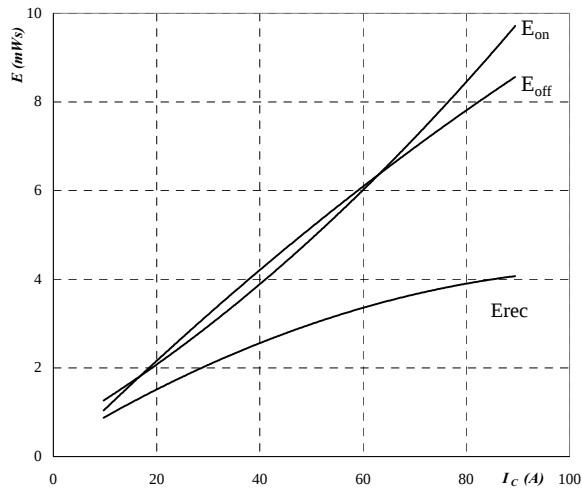


Figure 4. Typical diode forward current as a function of forward voltage
Output inverter FRED $I_F = f(V_F)$



Output inverter

Figure 5. Typical switching energy losses as a function of collector current
Output inverter IGBT
 $E = f(I_C)$



inductive load, $T_j = 125^\circ\text{C}$

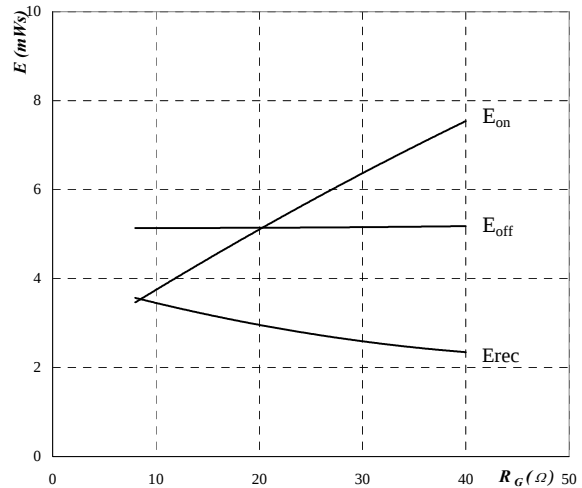
$V_{CE} = 600\text{ V}$

$V_{GE} = \pm 15\text{ V}$

$R_{gon} = 18\ \Omega$

$R_{goff} = 18\ \Omega$

Figure 6. Typical switching energy losses as a function of gate resistor
Output inverter IGBT
 $E = f(R_G)$



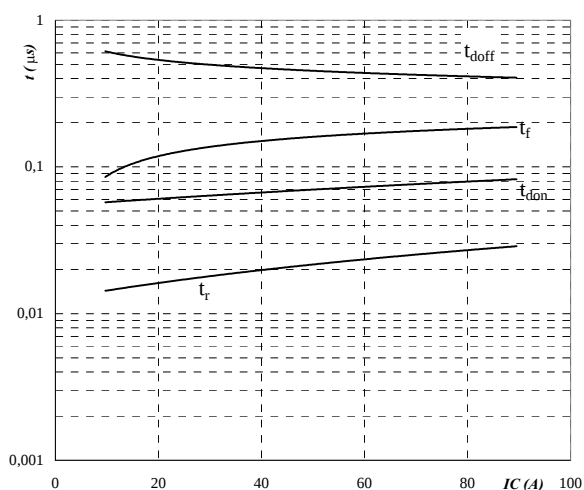
inductive load, $T_j = 125^\circ\text{C}$

$V_{CE} = 600\text{ V}$

$V_{GE} = \pm 15\text{ V}$

$I_C = 50\text{ A}$

Figure 7. Typical switching times as a function of collector current
Output inverter IGBT
 $t = f(I_C)$



inductive load, $T_j = 125^\circ\text{C}$

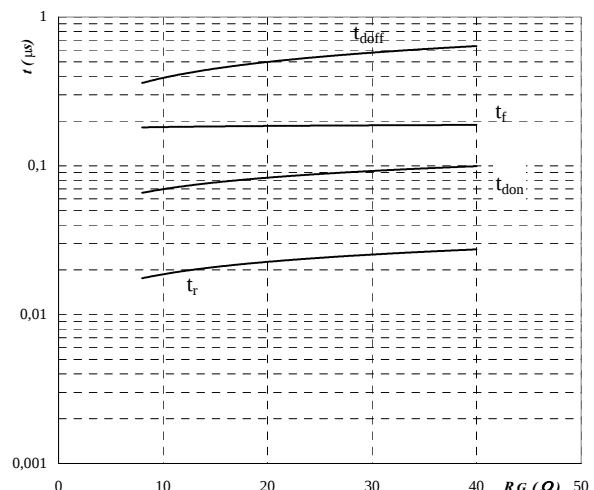
$V_{CE} = 600\text{ V}$

$V_{GE} = \pm 15\text{ V}$

$R_{gon} = 18\ \Omega$

$R_{goff} = 18\ \Omega$

Figure 8. Typical switching times as a function of gate resistor
Output inverter IGBT
 $t = f(R_G)$



inductive load, $T_j = 125^\circ\text{C}$

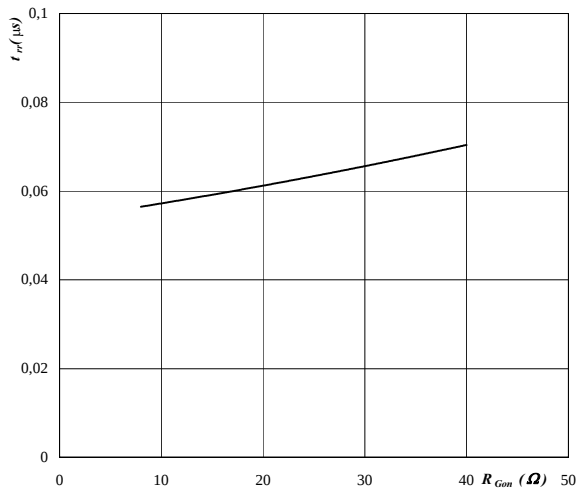
$V_{CE} = 600\text{ V}$

$V_{GE} = \pm 15\text{ V}$

$I_C = 50\text{ A}$

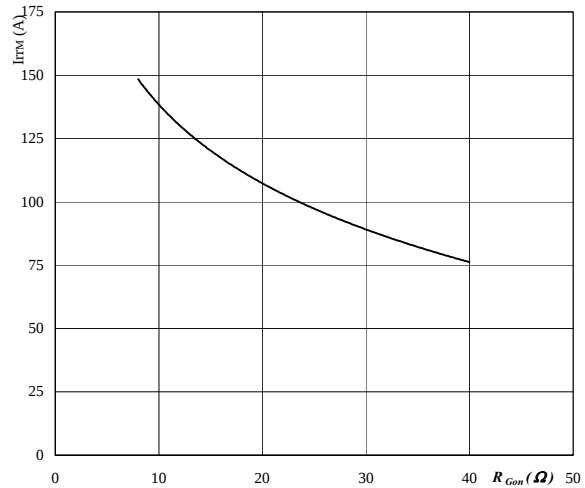
Output inverter

Figure 9. Typical reverse recovery time as a function of IGBT turn on gate resistor
Output inverter FRED diode
 $t_{rr} = f(R_{gon})$



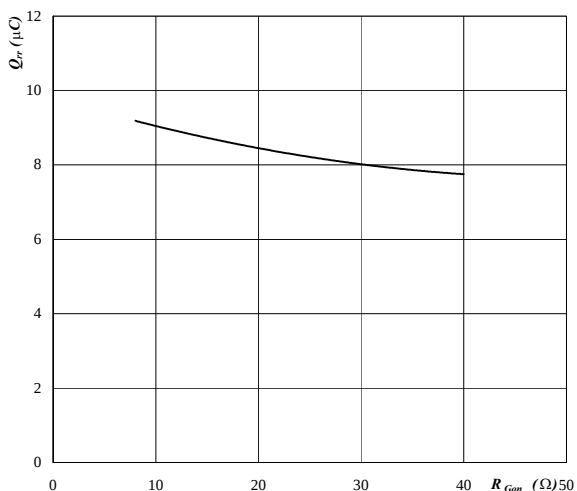
$T_j = 125\text{ }^{\circ}\text{C}$
 $V_R = 600\text{ V}$
 $I_F = 50\text{ A}$
 $V_{GE} = \pm 15\text{ V}$

Figure 10. Typical reverse recovery current as a function of IGBT turn on gate resistor
Output inverter FRED diode
 $I_{RRM} = f(R_{gon})$



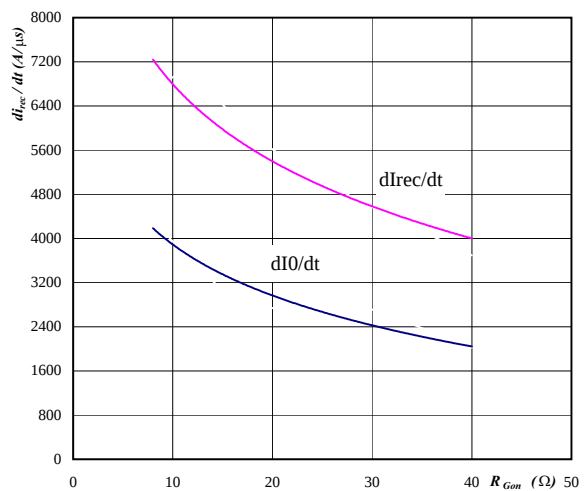
$T_j = 125\text{ }^{\circ}\text{C}$
 $V_R = 600\text{ V}$
 $I_F = 50\text{ A}$
 $V_{GE} = \pm 15\text{ V}$

Figure 11. Typical reverse recovery charge as a function of IGBT turn on gate resistor
Output inverter FRED diode
 $Q_{rr} = f(R_{gon})$



$T_j = 125\text{ }^{\circ}\text{C}$
 $V_R = 600\text{ V}$
 $I_F = 50\text{ A}$
 $V_{GE} = \pm 15\text{ V}$

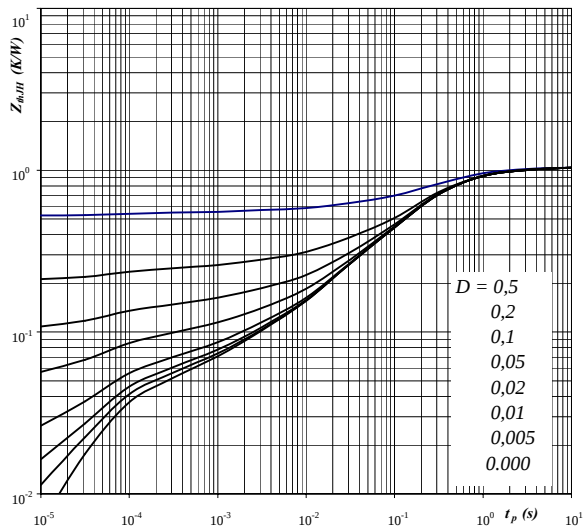
Figure 12. Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor
Output inverter FRED diode
 $dI_0/dt, dI_{rec}/dt = f(R_{gon})$



$T_j = 125\text{ }^{\circ}\text{C}$
 $V_R = 600\text{ V}$
 $I_F = 50\text{ A}$
 $V_{GE} = \pm 15\text{ V}$

Output inverter

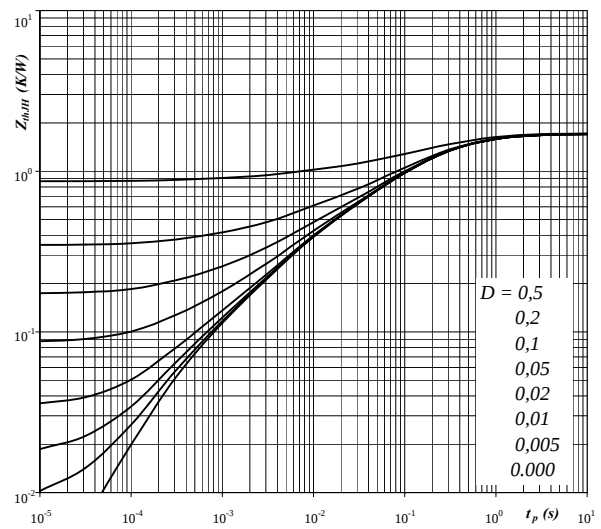
Figure 13. IGBT transient thermal impedance as a function of pulse width
 $Z_{thJH} = f(t_p)$


Parameter: $D = t_p / T$
 $R_{thJH} = 1,04 \text{ K/W}$

IGBT thermal model values

R (C/W)	Tau (s)
0,07	5,2E+00
0,28	7,1E-01
0,50	1,9E-01
0,12	2,0E-02

Figure 14. FRED transient thermal impedance as a function of pulse width
 $Z_{thJH} = f(t_p)$


Parameter: $D = t_p / T$
 $R_{thJH} = 1,72 \text{ K/W}$

FRED thermal model values

R (C/W)	Tau (s)
0,04	2,1E+01
0,25	1,1E+00
0,76	2,0E-01
0,41	3,4E-02

flowPACK 1, 1200V, 50A
Output inverter

Figure 15. Power dissipation as a function of heatsink temperature

Output inverter IGBT
 $P_{tot} = f(T_h)$

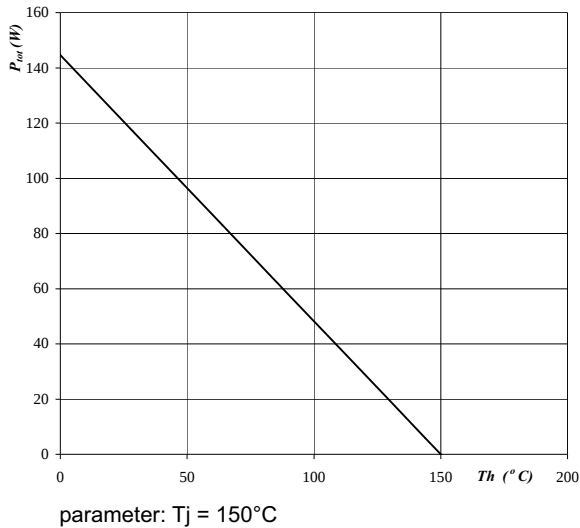


Figure 16. Collector current as a function of heatsink temperature

Output inverter IGBT
 $I_c = f(T_h)$

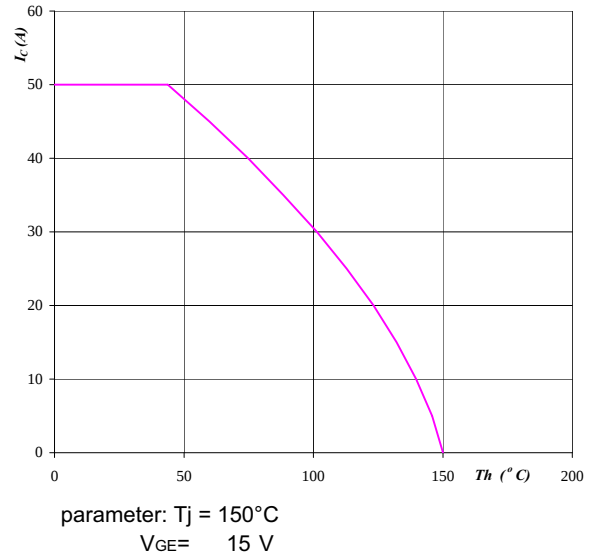


Figure 17. Power dissipation as a function of heatsink temperature

Output inverter FRED
 $P_{tot} = f(T_h)$

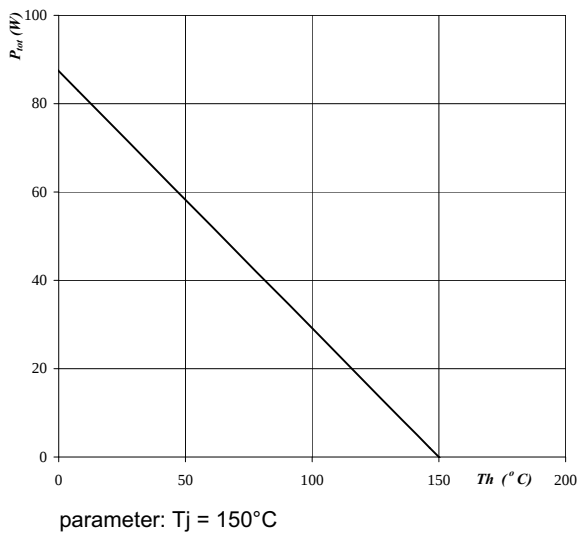
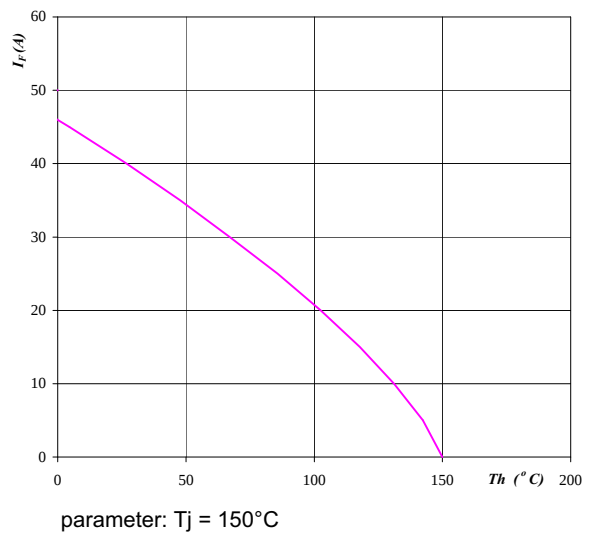


Figure 18. Forward current as a function of heatsink temperature

Output inverter FRED
 $I_F = f(T_h)$



Thermistor

**Figure 37. Typical NTC characteristic
as a function of temperature**

$$R_T = f(T)$$

